Abstract

A loudspeaker has a diaphragm with a voice coil disposed about its perimeter and extending in a gap into which the flux of an annular rare earth magnet is focused. An opening behind the diaphragm communicates through the speaker frame. The voice coil may have two or more windings that are connected in parallel, and may, e.g., be layered on top of one another, so that the impedance of the coil, as well as its depth in the front/back direction of motion, are low. The voice coil is preferably implemented using a polyimide form or bobbin, which has patterned lead-in conductors embedded therein to bring power to wire windings on the perimeter of the coil. The lead-in conductors extend to, or through, the central opening of a ring magnet, providing a robust ribbon input connection. The ribbon lead-in may be symmetrical, and the central opening further provides an air channel that couples to an auxiliary chamber for enhanced sound. The magnet rests on a generally cup-shaped rear pole piece that cooperates with a front washer-shaped pole piece to define the perimeter flux gap. The upper surface of the front washer inclines to a thinned inner edge, reducing central mass and providing added clearance to accommodate the lead-in ribbon in a widely-curved arc without contacting the magnet or diaphragm. The diaphragm may be domed to provide further clearance, and is mass-loaded by a material such as butyl rubber to lower its resonance and improve performance. In one sandwich construction, the front surface of the dome is entirely coated, and the rubber extends in a band around the edge. A flat diaphragm may also be used, and pole pieces may be formed of materials such as chrome vanadium instead of cheaper iron materials to further reduce the overall thickness and weight without sacrificing the gains in efficiency and engine strength of the basic construction. The design provides a phase coherent and uniform broad range response.